

## **BRIEF SUMMARY OF INVENTION - Version With Markings To Show Changes**

### **Made**

This invention presents a workbench of pallet rack construction comprising horizontal connecting structures, vertical posts and/or upright column members, and a workbench surface of one or more dry dimensional lumber boards, also called “framing lumber”, spanning parallel to the horizontal cross member and passing (boards that pass) unimpeded between the front and back vertical posts. Improvements in the horizontal connecting structure help(s) minimize work surface gaps while incorporating a second lip or flange below the upper lip (to utilize a support brace for the upper dimensional lumber boards also of dimensional lumber and running lengthwise between the front and back cross members. The upper lip supports dry dimensional lumber that creates the tabletop surface and spans left to right and parallel to the horizontal cross members. The lower lip supports dry dimensional lumber which provides cross bracing for the tabletop lumber and spans front to back and perpendicular to the upper surface. A right angle brace spanning front to back attaches to the front and rear horizontal cross member preventing the horizontal cross members from disengagement under table top vibration. The right angle brace containing a hole pattern of periodicity that captures the tabletop dry dimensional lumber and can be used in lieu of any other tabletop bracing.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The accompanying drawings illustrate preferred embodiments of the invention according to the practical application of the principles thereof and in which:

Figure 1 is a perspective view of a front portion of a pallet rack system comprising two vertical posts, a horizontal cross member spanning between the vertical uprights and the other components comprising the present invention.

Figure 2 is a perspective underside, internal to external view of a portion of a pallet rack system.

Figure 3 is a perspective view of the horizontal cross member shown in FIG. 1.

Figure 4 is a perspective view of the angle support brace shown in FIG. 2.

**BRIEF DESCRIPTION OF THE DRAWINGS – Version With Markings To Show Changes**

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The accompanying drawings illustrate preferred embodiments of the invention according to the practical application of the principles thereof and in which:

Figure 1 is a perspective view of a front portion of a pallet rack system comprising two vertical posts (uprights), a horizontal cross member spanning between the vertical uprights and the other components comprising the present invention.

Figure 2 is a perspective underside, internal to external view of a portion of a pallet rack system.

Figure 3 is a perspective view of the horizontal cross member show in FIG. 1.

Figure 4 is a perspective view of the angle support brace shown in FIG. 2.

## **DETAILED DESCRIPTION OF THE INVENTION**

The principle of the present invention is to create a pallet rack style workbench where dry dimensional lumber pieces, such as 2x4's, 2x6, 2x8's, etc. can be used for the tabletop and all bracing. Hence forth in this document the term "dimensional lumber," also referred to in the industry as dry dimensional lumber, and/or framing lumber, shall have the dressed size dimensional width in accordance with the American Softwood Lumber Standard, DOC PS 20-99, developed in accordance with the Procedures for the Development of Voluntary Product Standards, of the U.S. Department of Commerce. A portion of rack system is shown in FIG. 1-2 comprising two vertical posts 10, a horizontal cross member 20, a right angle brace 40, three dimensional lumber shelf boards 51, and a dimensional lumber support board 50. As depicted in U.S. Pat. No. 3,871,525 and 5,713,476 and known to the art, each side of the rack constitutes a front and back vertical post 10 attached by U-shaped front to back metal members that set the front to back depth of the pallet rack system and create a vertical structure often referred to as a single pallet rack "vertical upright". As shown in U.S. Pat. No. 5,350,074, the U-shaped brackets are welded to the vertical posts 10 in the region where the U-shaped metal brace intersect the vertical post 10, in-turned lip surface 14. Improvements by the present invention create a pallet rack style workbench comprised of dimensional lumber, sometimes defined as "framing" lumber and/or "dry dimensional lumber," whose dimensions are defined by the American Lumber Standard. In doing so, the distance between a front and back vertical post in-turned lip surface 14 is set to an integral number of dry dimensional lumber boards 51 times the width of the lumber and a tolerance to account for the lumber moisture content and wood warp. This enables the dimensional lumber shelf boards 51 to lie parallel to the horizontal cross members 20 and unimpeded between the vertical posts 10, while also minimizing the gap between the vertical posts 10 and the sides of the dimensional lumber shelf boards 51 laid closest to the vertical posts 10.

Each vertical post 10 is a formed steel channel with a rectangular cross section having an external wall 12, two side walls 13, and in-turned lips 14 FIG. 2. The vertical post external wall 12 of the vertical posts 10 contains two rows of vertically displaced apertures 11, generally of a key hole shape and vertically symmetrical about the vertical axis FIG. 1. The apertures 11 along the vertical post 10 are equally spaced and are of a tear drop shape with a large opening at the top tapering down to a smaller opening at the bottom. Spanning between two vertical posts 10 either in the front or rear of the rack system are the horizontal cross members 20.

As shown in FIG. 3, the horizontal cross members 20 are made of roll formed steel and comprised of an outer wall 22, an upper surface 23, an inner wall 24, an upper lip and/or flange 25, a lower lip and/or flange 26, and two horizontal cross member brackets 21. Each horizontal cross member bracket 21 is an L-shaped bracket comprised of a horizontal cross member bracket wall 28 and a cross member bracket flange 29. The L-shaped bracket constitutes a corner that butts up to the vertical post side 13 and vertical post outer face 12 FIG. 1-2. Two or more rivets 31 located on the horizontal cross member bracket flange 29 when inserted fully into the equally spaced apertures 11 located on the vertical posts 10, engage either two front or two back vertical posts creating a rigid attachment, as shown in FIG. 1-2.

FIG. 2 shows a rear perspective view of the front portion of the rack system. Positioned and running parallel to the horizontal cross member 20 are dimensional lumber shelf boards 51. The previous art in rack construction shows a lip on the horizontal cross members that provide containment for a wood board resting on the lip and spanning front to back of the rack structure. However, the positioning of the lip and the welded brackets located at each end of the metal rolled formed horizontal cross members prevents the plywood board or dimensional lumber boards from laying unimpeded between the vertical posts. Several improvements in the horizontal cross member 20 defined by the present invention enable dimensional lumber shelf boards 51 to be placed parallel to the horizontal cross member allowing for unimpeded routing between a front and rear vertical post 10. As shown in FIG. 1 and FIG. 3, the horizontal cross

member upper surface 23 is extended inward towards the center of the rack system at a distance equivalent within some manufacturing tolerance to the width of the vertical post side wall 13. When using a pallet rack design as a workbench surface, minimizing the gap between the horizontal cross member inner wall 24 and the sides of the dimensional lumber shelf boards 51 closest to the wall prevents objects from falling within the gap. By extending the horizontal cross member upper surface 23, the horizontal cross member upper lip 25 initiates inward at a position in the pallet rack construction equivalent within some tolerance to that of vertical post in-turned lip surface 14 FIG. 2. Regardless of whether dimensional lumber shelf boards 51 or plywood is laid on the horizontal cross member upper lip 25, the horizontal cross member upper lip 25 as shown in the present invention must initiate inward to the center of the rack at a position to clear the vertical posts 10. In addition and to allow dimensional lumber to lay horizontal to the horizontal cross members 20 and unimpeded between the vertical posts 10, the horizontal cross member bracket wall 28 must not extend inward to the center of the rack beyond the horizontal cross member inner wall 24 or above the horizontal cross member upper lip 25. As one skilled in the art would expect, care needs to be exercised in welding of the horizontal cross member bracket wall 28 to the roll formed metal horizontal cross member so as not to impede travel of the dimensional lumber shelf boards 51.

As shown in FIG. 1-2, for a workbench to be rugged with a sturdy work surface that can withstand significant weight or vibration, it is desirable to use dimensional lumber as shelf boards 51 because it is readily available, has a wood grain structure to improve structural loading, and comes in various lengths. It is also desirable to make the work surface a continuous flat surface from the front to the back. A continuous work surface is accomplished in the present invention by setting the horizontal cross member inner wall 24 to the thickness of dimensional lumber shelf boards 51 as defined by the American Lumber Standard FIG. 1, or if desired to the thickness of plywood as also defined by the American Lumber Standard. As shown in FIG. 2, increased structural stiffness is accomplished by using the dimensional lumber support board 50 as a brace

for the dimensional lumber shelf boards 51. The dimensional lumber support board 50 spans from the front horizontal cross member lower lip 26 to a back horizontal cross member lower lip 26. As shown in FIG. 3, positioning of the dimensional lumber support board 50 is accomplished by creating a horizontal cross member lower lip 26, with the lower lip positioned below the upper lip 25 a dimensional distance equivalent to the height of dimensional lumber as defined by the American Lumber Standard plus some manufacturing tolerance. A pattern of holes 27 created for a particular width of dimensional lumber and the pattern repeated periodically along the length of the lower lip allows for the lumber boards to be rapidly secured to the lip with wood screws while preventing the wood screws from splitting or warping the dimensional lumber support boards. This eliminates the need for the user and/or consumer to drill holes that align properly with the placement of the boards. In the event the user might want to use only plywood as the top surface, a similar pattern of holes is applied to the horizontal cross member upper lip 25 so that the end user can utilize the horizontal cross member upper lip 25 with similar functionality as the horizontal cross member lower lip 26.

Desirable in a workbench or pallet rack construction is to prevent disengagement of the horizontal cross members 20 under vibration created by power tools or hammering on the work surface. Also of similar importance is to provide a continuous work surface and a flat work surface routing left to right of particular vertical post or upright structure. As shown in FIG. 2, this is accomplished by the right angle brace 40 that attaches to the front and back horizontal cross members 20. A pair of right angle brace mounting holes 44 located on the right angle brace side 42 enable the right angle brace 40 to attach by a bolted joint with the horizontal cross member 20, using cross bracket mounting holes 30. This prevents disengagement of the horizontal cross members 20. Because the dimensional lumber support boards 50 sit below the horizontal cross member upper lip 25, the right angle brace 40 can be used as the right and left supports to maintain a relatively constant tabletop height. In a configuration of 6 or more vertical posts, two right angle braces 40 can be used in conjunction with a front and back vertical post or

“vertical upright” to create a butt joint for the dimensional lumber shelf boards 51 spanning right and left of the vertical posts. Similar to the horizontal cross member upper 25 and lower lips 26, a pattern of holes 43 created for a particular size of dimensional lumber can be repeated periodically along the length of the right angle brace flange 41, allowing for the dimensional lumber shelf boards 51 to be rapidly secured to the lip with wood screws. The benefit of such a predefined pattern is to prevent the user from having to drill the pattern necessary to capture the desired dimensional board type.

## **DETAILED DESCRIPTION OF THE INVENTION - Version With Markings To Show**

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The principle of the present invention is to create a pallet rack style workbench where dry dimensional lumber pieces, such as 2x4's, 2x6, 2x8's, etc. can be used for the tabletop and all bracing. Hence forth in this document the term "dimensional lumber," also referred to in the industry as dry dimensional lumber, and/or framing lumber, shall have the dressed size dimensional width in accordance with the American Softwood Lumber Standard, DOC PS 20-99, developed in accordance with the Procedures for the Development of Voluntary Product Standards, of the U.S. Department of Commerce. A portion of rack system is shown in FIG. 1-2 comprising two vertical posts 10, a horizontal cross member 20, a right angle brace 40, three dimensional lumber shelf boards 51, and a dimensional lumber support board 50. As depicted in U.S. Pat. No. 3,871,525 and 5,713,476 and known to the art, each side of the rack constitutes a front and back vertical post 10 attached by U-shaped front to back metal members that set the front to back depth of the pallet rack system and create a vertical structure often referred to as a single pallet rack "vertical upright". As shown in U.S. Pat. No. 5,350,074, the U-shaped brackets are welded to the vertical posts 10 in the region where the U-shaped metal brace intersect the vertical post 10, in-turned lip surface 14. Improvements by the present invention create a pallet rack style workbench comprised of dimensional lumber, sometimes defined as "framing" lumber and/or "dry dimensional lumber," whose dimensions are defined by the American Lumber Standard. In doing so, the distance between a front and back vertical post in-turned lip surface 14 is set to an integral number of dry dimensional lumber boards 51 times the width of the lumber and a tolerance to account for the lumber moisture content and wood warp. This enables the dimensional lumber shelf boards 51 to lie parallel to the horizontal cross members 20 and unimpeded between the vertical posts 10, while also minimizing the gap between the vertical posts 10 and the sides of the dimensional lumber shelf boards 51 laid closest to the vertical posts 10.

Each vertical post 10 is a formed steel channel with a rectangular cross section having an external wall 12, two side walls 13, and in-turned lips 14 FIG. 2. The vertical post external wall 12 of the vertical posts 10 contains two rows of vertically displaced apertures 11, generally of a key hole shape and vertically symmetrical about the vertical axis FIG. 1. The apertures 11 along the vertical post 10 are equally spaced and are of a tear drop shape with a large opening at the top tapering down to a smaller opening at the bottom. Spanning between two vertical posts 10 either in the front or rear of the rack system are the horizontal cross members 20.

As shown in FIG. 3, the horizontal cross members 20 are made of roll formed steel and comprised of an outer wall 22, an upper surface 23, an inner wall 24, an upper lip and/or flange 25, a lower lip and/or flange 26, and two horizontal cross member brackets 21. Each horizontal cross member bracket 21 is an L-shaped bracket comprised of a horizontal cross member bracket wall 28 and a cross member bracket flange 29. The L-shaped bracket constitutes a corner that butts up to the vertical post side 13 and vertical post outer face 12 FIG. 1-2. Two or more rivets 31 located on the horizontal cross member bracket flange 29 when inserted fully into the equally spaced apertures 11 located on the vertical posts 10, engage either two front or two back vertical posts creating a rigid attachment, as shown in FIG. 1-2.

FIG. 2 shows a rear perspective view of the front portion of the rack system. Positioned and running parallel to the horizontal cross member 20 are dimensional lumber shelf boards 51. The previous art in rack construction shows a lip on the horizontal cross members that provide containment for a wood board resting on the lip and spanning front to back of the rack structure.(;) (however) However, the positioning of the lip and the welded brackets located at each end of the metal rolled formed horizontal cross members prevents the (a) plywood board or dimensional lumber boards from laying unimpeded between the vertical posts. Several improvements in the horizontal cross member 20 defined by the present invention enable dimensional lumber shelf boards 51 to be placed parallel to the horizontal cross member allowing for unimpeded routing between a front and rear vertical post 10. As shown in FIG. 1 and FIG. 3,

the horizontal cross member upper surface 23 is extended inward towards the center of the rack system at a distance equivalent within some manufacturing tolerance to the width of the vertical post side wall 13. When using a pallet rack design as a workbench surface, minimizing the gap between the horizontal cross member inner wall 24 and the sides of the dimensional lumber shelf boards 51 closest to the wall prevents objects from falling within the gap. By extending the horizontal cross member upper surface 23, the horizontal cross member upper lip 25 initiates inward at a position in the pallet rack construction equivalent within some tolerance to that of vertical post in-turned lip surface 14 FIG. 2. Regardless of whether dimensional lumber shelf boards 51 or plywood is laid on the horizontal cross member upper lip 25, the horizontal cross member upper lip 25 as shown in the present invention must initiate inward to the center of the rack at a position to clear the vertical posts 10. In addition and to allow dimensional lumber to lay horizontal to the horizontal cross members 20 and unimpeded between the vertical posts 10, the horizontal cross member bracket wall 28 must not extend inward to the center of the rack beyond the horizontal cross member inner wall 24 or above the horizontal cross member upper lip 25. As one skilled in the art would expect, care needs to be exercised in welding of the horizontal cross member bracket wall 28 to the roll formed metal horizontal cross member so as not to impede travel of the dimensional lumber shelf boards 51.

As shown in FIG. 1-2, for a workbench to be rugged with a sturdy work surface that can withstand significant weight or vibration, it is desirable to use dimensional lumber as shelf boards 51 because it is readily available, has a wood grain structure to improve structural loading, and comes in various lengths. It is also desirable to make the work surface a continuous flat surface from the front to the back. A continuous work surface is accomplished in the present invention by setting the horizontal cross member inner wall 24 to the thickness of dimensional lumber shelf boards 51 as defined by the American Lumber Standard FIG. 1, or if desired to the thickness of plywood as also defined by the American Lumber Standard. As shown in FIG. 2, increased structural stiffness is accomplished by using the dimensional lumber support board 50 as a brace

for the dimensional lumber shelf boards 51. The dimensional lumber support board 50 spans from the front horizontal cross member lower lip 26 to a back horizontal cross member lower lip 26. As shown in FIG. 3, positioning of the dimensional lumber support board 50 is accomplished by creating a horizontal cross member lower lip 26, with the lower lip positioned below the upper lip 25 a dimensional distance equivalent to the height of dimensional lumber as defined by the American Lumber Standard plus some manufacturing tolerance. A pattern of holes 27 created for a particular width of dimensional lumber and the pattern repeated periodically along the length of the lower lip allows for the lumber boards to be rapidly secured to the lip with wood screws while preventing the wood screws from splitting or warping the dimensional lumber support boards. This eliminates the need for the user and/or (and or) consumer to drill holes that align properly with the placement of the boards. In the event the user might want to use only plywood as the top surface, a (A) similar pattern of holes is applied to the horizontal cross member upper lip 25 so that the end user can utilize the horizontal cross member upper lip 25 with similar functionality as the horizontal cross member lower lip 26.

Desirable in a workbench of pallet rack construction is to prevent disengagement of the horizontal cross members 20 under vibration created by power tools or hammering on the work surface. Also of similar importance is to provide a continuous work surface and a flat work surface routing left to right of particular vertical post or upright structure. As shown in FIG. 2, this is accomplished by the right angle brace 40 that attaches to the front and back horizontal cross members 20. A pair of right angle brace mounting holes 44 located on the right angle brace side 42 enable the right angle brace 40 to attach by a bolted joint with the horizontal cross member 20, using cross bracket mounting holes 30. This prevents (, thus preventing) disengagement of the horizontal cross members 20. Because the dimensional lumber support boards 50 sit below the horizontal cross member upper lip 25, the right angle brace 40 can be used as the right and left supports to maintain a relatively constant tabletop height. In a configuration of 6 or more vertical posts, two right angle braces 40 can be used in conjunction with a

front and back vertical post or “vertical upright” to create a butt joint for the dimensional lumber shelf boards 51 spanning right and left of the vertical posts. Similar to the horizontal cross member upper 25 and lower lips 26, a pattern of holes 43 created for a particular size of dimensional lumber (and the pattern) can be repeated periodically along the length of the right angle brace flange 41, allowing (allows) for the dimensional lumber shelf boards 51 to be rapidly secured to the lip with wood screws. The benefit of such a predefined pattern is to (eliminate for) prevent the user from having to drill the pattern necessary to capture the desired dimensional board type. (additional holes to prevent splitting the dimensional lumber shelf boards 51 by screw insertion or wood warp from inadequate capture of the shelf boards).